

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

I. Status of the Claims

Claims 18-20 and 22-26 are pending and subject to examination on the merits.

II. Interview Summary

Applicants thank Examiner Grant for the courtesy of granting a telephonic interview to discuss the present application on February 15, 2007. The Interview Summary of February 15th accurately reflects the interview. More specifically, Applicants explained that Phillips does not anticipate the claimed invention for two reasons. First, Phillips does not employ “frequency modulated screening,” as required by the present claims. In fact, Phillips predates the advent of “frequency modulated screening.” Second, Phillips is not directed to a “target for calibration of digital input devices.” Instead, Phillips is directed to sheets that can be used with printers to print high quality versions of artwork. These two distinctions are discussed in greater detail below in Section III. Applicants understand that in response to this communication the Examiner will either issue a Notice of Allowance or a new non-final Office Action based on the art recognized definition of “frequency modulated screening.”

III. Claim Rejections – 35 U.S.C. § 102

Claims 18-20 and 22-26 stand rejected under 35 U.S.C. § 102 as allegedly anticipated by U.S. Patent No. 4,629,428 to Phillips. According to the Office Action, “Phillips teaches a target (see figure 5; see also col. 5, lines 20-25) for calibration of digital devices, comprising a plurality of colored fields, (see fig. 5 and col. 4, line 50 – col. 5, line 25., wherein the colored fields are printed by a subtractive multicolor printing process by means of frequency modulated screening (see figures 3e-3d and the CMYK subtractive colors.)” Office Action at 2. Applicants respectfully traverse this ground of rejection.

Phillips fails to teach or suggest the claimed invention for two reasons. First, Phillips fails to teach or suggest a target printed using “frequency modulated screening,” as required by the present claims. Second, Phillips generally relates to a process and equipment for color printing, but does not teach or suggest a “target for calibration of digital input devices,” as required by the present claims. Each of these reasons is discussed below.

A. Summary of the Claimed Invention

The claimed invention is directed to a “target for calibration of digital input devices” and a method of using such a target. Targets for calibration of digital devices were known in the art. However, these known targets suffered from a number of problems, such as Moire pattern and relatively large production costs. The present invention provides a solution to that problem by providing a “target for calibration of digital input devices” printed using “frequency modulated screening.” Due to the use of frequency modulated screening, the targets of the claimed invention do not suffer from Moire patterns and are much cheaper to produce than targets known in the art. Thus, the claimed targets offer a significant advantage over those targets known in the art.

B. Phillips Fails To Teach or Suggest a Target Printed Using “Frequency Modulated Screening”

Phillips cannot anticipate the claimed invention because Phillips contains no teaching or suggestion to use “frequency modulated screening,” as required by the present claims. As discussed during the February 15th interview, “frequency modulated screening” (“FMS”) was developed around 1994 (Exhibit A) and is now a common term in the art to describe a specific type of printing. FMS is generally understood in the art to be a printing method that prints dots in an irregular, *i.e.*, random pattern. *See, e.g.*, Exhibits B & C. In contrast, conventional screening methods employ spots of the varying sizes with each spot’s “middle point equidistant from that of its neighbours.” *See* Exhibit B. Thus, FMS differs from conventional printing in that, *inter alia*, FMS places spots in an irregular pattern and conventional printing places spots of different sizes a fixed distance apart from one another.

FMS modulated screening offers a number of advantages over convention printing techniques. Notably, FMS eliminates Moire effects. Exhibit D; Exhibit E at col. 3, ll. 19-40.

Phillips does not employ “frequency modulated screening.” Instead, Phillips employs conventional printing techniques. In fact, it was impossible for Phillips to employ FMS because “frequency modulated screening” was not developed until around 1994, well after the Phillips filing date. Moreover, Phillips makes clear that it did not employ FMS. For example, Phillips emphasizes the importance of avoiding Moire fringe patterns by teaching that “[i]f it is found that [Moire patterns] occur ... then the choice of percentages is readjusted to *eliminate any tint with the Moire pattern*” (col. 5, lines. 35-39 (emphasis added)). Thus, Phillips simply eliminates tints that exhibit Moire pattern. If FMS had been used, such elimination would be unnecessary because the printing technique itself avoids Moire patterns. As another example, Phillips states as follows: “There should also be means to identify the shapes, patterns and densities of the dots or other shapes in the percentage density screens, and line spacing and angle” (col. 3, lines 9-12). This is not possible using frequency modulated screening. Using FMS, shapes, patterns, and dots are random, so line spacing and angles can not be defined. Thus, Phillips does not teach the use of a “frequency modulated screening” process.

C. Phillips Fails To Teach or Suggest A “Target for Calibration of Digital Input Devices”

Phillips teaches the printing of a kit comprising selected color tints for use by artists concerned with the correct printing of their artwork (*see* Abstract Lines 1-5). The Phillips kit is similar to the color samples used by painters to allow customers to choose the color they want for their living room walls or house exterior. The customer selects a sample (dried) of the available colors and the painter looks on the back of each sample for a standard formula that tells him/her how to have the color mixed (from a smaller set of base’ colors) at the local paint retailer. Paint colors that can not be mixed using standard colors are simply not present. The Phillips’ kit employs the same technique to printing.

In contrast, the present invention is directed to a “target for calibration of digital input devices.” These targets are used with a “digital input device,” such as a scanner or a digital camera, to ensure that colors produced by the “digital input device” are correct. Generally, these calibration targets can be used as follows: (1) a target is produced according to the method described in our patent application; (2) the colored patches on the target are measured and stored in a reference file; (3) the target is photographed using a digital camera or scanned using a digital scanner; (4) the resulting image is analyzed to determine the colors produced by the digital device; (5) these colors are then compared to the reference file colors; and (6) the differences are used to create an industry standard “profile” which can be used (among other purposes) to correct the colors in the original or subsequent digital images. Using mathematical interpolation, the profile is capable of “correcting” any color produced by the input device. Using the appropriate profile, the digital input device is now said to be “calibrated.” Thus, the target of the present invention is entirely different than the color kit of Phillips.

Phillips mentions that an “electronic scanner” (col. 6, line 59) or “digital scanning” (col. 3, lines 28 and col. 6, line 63) can be used to for the automated production of the lithographic screens that are used in the Phillips printing method. However, Phillips does not suggest the “calibration” of these devices or any other digital input device. Calibration refers to a process of characterization of the input device and the production of information to correct the colors produced by the device. The printing of a kit used to select colors that can be printed is not the same as printing a chart to measure the accuracy of and correct the colors produced by a digital input device. Thus, Phillips does not teach or suggest a “target for calibration of digital input devices.”

CONCLUSION

The present application is now in condition for allowance. An early indication to that effect is earnestly solicited.


The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance prosecution.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. § 1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

Date 22 February 2007

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FM screening: big gains from tiny dots? - frequency modulated screening for printed pictures

Paul McDougall

A recent breakthrough in screening technology could ultimately mean sharper pictures for readers, and lower prepress bills for publishers--although most experts say some big issues need to be resolved before the process gains wide acceptance in the publishing community. If it works as planned, however, stochastic, or frequency modulated (FM) screening, also promises to eliminate a number of technical gremlins from the printing process and reduce turnaround time for most jobs.

Vendors hoping for dot gains

The technology's basics were developed several years ago by German technicians, but it is only recently that the high-performance computers needed to calculate FM screening's daunting algorithms have become widely available. Several well-known vendors, including Scitex, Agfa, and Linotype-Hell, have equipped raster image processors with their own versions of the technology. Meanwhile, some large printers are beginning to incorporate FM screening into their operations. New York City-based World Color Press, for instance, used Agfa's CristalRaster to produce the December cover of McCall's Needlework & Crafts for PJS Publications.

Another print giant, Chicago-based R.R. Donnelley & Sons, has developed its own FM screening system, dubbed AccuTone. Company spokeswoman Carrie Foor says "a major publisher" this month plans to test the systems against one another in "a stochastic shootout." Results of those tests could go a long way in determining which companies will take the early lead in efforts to market FM screening, a potentially critical value-added offering for vendors and printers seeking to attract customers in a market where prices remain at rock-bottom levels.

The fine points of FM screening

In conventional screening, images on film consist of variably sized dots--larger dots fool the eye into perceiving darker shades, while smaller dots create the impression of lighter tones. For years, this process has allowed printers using the four-color inks to simulate the full color spectrum. FM screening, however, takes the process to the next level by using what experts say is a more efficacious approach to halftone reproduction--replacing the traditional dots with tiny, uniform "microdots" that are scattered across the page. Tightly spaced microdots appear as darker tones, while those more widely dispersed render lighter image areas. Thus in FM screening, it is the frequency, rather than the amplitude, of the dots that controls tonal values.

This approach offers a number of potential improvements. Among the most notable are smoother tonal gradations and sharper details throughout the color spectrum. The conventional screening method works best with very dark and very light tones, but runs into trouble in the midranges--where colors can "jump" from one shade to the next. In FM screening, the microdots are not confined to a grid and therefore can be randomly placed for optimal image reproduction.

"Conventionally, in, say, a 20 percent cyan, the distance between halftone dots is constant, but the size varies," explains Liane Buix, production specialist for RIP and screening technology at Lino-type-Hell in Hauppauge, New York. "The halftone dots will be small, but the spaces will be large--which means you'll get more white areas. In FM, the spots are scattered to create better page coverage. It almost looks like a fifth color [ink has been used~]."

Others note that FM screening also alleviates moire--an unwanted, rosette-like pattern that can appear on traditionally

screened images if screen angles are improperly aligned. That could make the process particularly effective for fashion layouts, which can often suffer from moire when clothing patterns closely resemble the patterns of halftones on a grid.

Trouble spots

Still, a number of matters must be resolved before FM screening can make big inroads into the publishing community. Not surprisingly, one of the biggest issues is cost. FM screening does allow users to output quality files at relatively low resolutions, which ultimately means faster turnaround and lower bills from the pre-press shop. But some industry observers feel that all but the fastest RIPs will get bogged down in the computational stage of the process. If that happens, pre-press costs could actually rise.

Dot gain is another problem area. Simply put, images that are screened stochastically tend to contain many more dots than those that are processed conventionally. Thus, the effects of some common pre-press errors that often tend to cause dot gain will be magnified.

Proofing also remains a question mark. Today's digital proofers are not capable of re-creating FM screening's dot structure. To proof stochastic files, Linotype's Buix recommends aqueous laminate-based devices over those that are toner-based.

Finally, stochastic screening may create yet another compatibility issue between publishers and advertisers, since printers are not yet capable of running hybrid jobs. In other words, if editorial pages have been FM screened, then files from advertisers must be similarly processed.

Still, few doubt that the technology has big potential, and could give publishers who use it an edge on the competition. Says Wayne Mathison, executive vp/manufacturing and design at PJS: "It looks a whole lot better; we're almost getting photographic quality."

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Aug 27, 2003

To visit the Heidelberg website, click on www.heidelberg.com

**Heidelberg Offers Latest-Generation
Frequency Modulated Screening**

*Satin Screening available for Prinect Printready
System, MetaDimension and Delta Technology*

26.08.2003—Heidelberger Druckmaschinen AG (Heidelberg) offers now a frequency modulated (FM) screening technology known as Satin Screening for Delta Technology, MetaDimension and Prinect Printready System. This technology is thus also available for Heidelberg's new PDF- and JDF-based RIP and Workflow solutions.

"Satin Screening reinforces our extensive portfolio of screening processes with a new generation of optimized FM screening technology. This will enable our customers to satisfy the growing demand for high-quality print products and to profit from the benefits of FM screening in print production", stated Dr. Klaus Spiegel, Heidelberg Director responsible for the Sheetfed Solution Center.

Satin Screening delivers print reproductions of photos and graphics in absolute high-end quality. The key features include reproduction of fine details, high smoothness particularly in the mid-tones, smooth vignettes and high process and color stability. Satin Screening prevents the usual problems that can occur with conventional screening technologies, for example moiré, restrictions caused by the screen angles, and problems with vignettes.

In view of the latest technical advances made with computer-to-plate systems, which enable higher imaging quality and greater consistency in terms of process control, Heidelberg anticipates that demand for optimized frequency modulated screening can only increase. The new screening method will be launched on the market in 3Q 2003. The established screening methods IS (Irrational Screening), HQS (High Quality Screening), MegaDot and Diamond Screening will remain in the Heidelberg portfolio.

Note for journalists

Frequency modulated screening: This screening method positions spots of variable size in an irregular pattern in order to simulate color tones. Frequency modulated screening technologies use computer algorithms to place the spots at the precise location in the scanned image in accordance with the tonal values. The very latest generation of these technologies, such as Satin Screening, are superior to the first generation as they use more complex algorithms for higher quality reproduction.

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PreMedia > Frequency Modulated screening

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Repro specifications
for offset

Parameters for
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Computer to Plate

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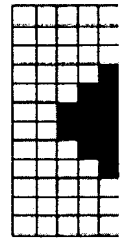
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available films and
prints

Digital layouts

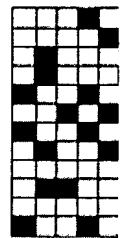
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Frequency Modulated screening



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Frequency Modulated screening - a definition

With conventional screening the individual screen dots are of varying sizes and each dot is placed with its middle point equidistant from that of its neighbours.

In Frequency Modulated screening all dots are the same size. What is changed is the number of dots per unit of area. Dot distribution follows the principle of mathematical randomness (see diagram). The size of the dot is considerably smaller in Frequency Modulated screening than in conventional screening. The many small dots would equal the size of one conventional dot on a given area.

Qualitative advantages and disadvantages

The significant advantage of Frequency Modulated screening lies in the fact that it produces a printed quality with excellent detail sharpness, similar to a photograph. This is a result of the substantially higher resolution and the random distribution of the dots, which avoids the step effect edges in graphic elements.

No moiré patterns appear with Frequency Modulated screening because there are no line structures or screen angling, which is sometimes the case in conventional dot screens with certain screen angling overlaps. For the same reason Frequency Modulated screening prevents the occurrence of "rosette" structures.

These qualitative advantages are balanced by the disadvantage that single tone areas can become grainy and colour fluctuations occur with Frequency Modulated screening, which can produce unevenness in the printing. This results from the random distribution system, which may place more dots in some areas and less in others. This effect is accentuated when several colours are printed on top of each other, and the degree to which it occurs depends on the quality of the software controlling the random distribution of the dots in the RIP.

FMS renaissance via CTP

The use of frequency modulated screening was, in practice, still limited. The biggest problem was the side lighting effect, which repeatedly occurred when the FM screen was transferred to traditional copying technology. This, however, is not a problem with CTP direct image transfer. The size of a single point which can be traditionally copied is between 14 and 18 μ . In contrast, with CTP transfer it is possible to transfer points between 6 and 8 μ in size; the resulting sharpness of the pictures is impressive. Thanks to CTP direct image transfer, the previously high production technology requirements have largely ceased to apply.

The effects of FM screening on printing

Plates which have been produced from Frequency Modulated screened films do not normally cause any difficulties in the printing process. Indeed, this is advantageous especially when the same film is used for different types of paper. Frequency Modulated screened pictures are also less sensitive in relation to the ink supply. This means that, in contrast to the conventional screen, when there is a significantly increased ink supply in order to achieve greater colour intensity, it is not necessary to add three quarter tones. A condition for this is, however, that the gradation is adapted in CTP plate production because of the characteristically steeper increase in the tone value curve compared to conventional screening. An 85% tone value of a given conventional screen achieves a tone value equivalent to 100% with a Frequency Modulated screen.

With long print-runs, as are common in web offset, additional printing plates are necessary as friction destroys the smaller screen dots more quickly.

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"A Comparison of Commercial Frequency-Modulated Screening Algorithms"

Original language : English

Year : 1995 Author : Heikkilä, I.

Graphic Arts in Finland 24(1995)2, 3–10.

Based on the fact that a frequency-modulated (FM) screen has very good visual quality and is free from moiré or rosette, FM screening is becoming increasingly widely used in the graphic arts industry. Since FM screening can be based on different underlying concepts, a comparison of commercial FM screening algorithms is of interest. The purpose of this paper is to evaluate to what extent the visual noise present in FM screens depends on the screening algorithm. This paper studies the noise of uniform surfaces with different dot percentages. The measurement is based on imaging the screen with a CCD video camera.

Due to the non-ideal nature of the imaging device, the detected signal is filtered by a CCD video camera. In this paper, the input signal is computed by deconvolving the detected signal with the point spread function of the CCD video camera. A measurement method is described for the point spread function of a CCD video camera, based on sharp-pin imaging. In addition, the effect of imaging noise on the results is discussed. Before power spectrum analysis, the computed input signal was weighted by the MTF of human visual system.

In analysis, the visual noise of the screened area was found to depend to a great extent on the algorithm used in screening. In addition, the noise of the screened area was found to depend on the dot percentage.

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US006406833B1

(12) **United States Patent**
Nouel(10) **Patent No.:** **US 6,406,833 B1**
(45) **Date of Patent:** **Jun. 18, 2002**(54) **USE OF FREQUENCY-MODULATED
SCREENING FOR LIGHTENING OFFSET
PRINTING SURFACES**5,283,154 A 2/1994 Stein 430/303 X
5,379,118 A * 1/1995 Steinhardt et al. 358/298
5,818,604 A * 10/1998 Delabastita et al. 358/298(76) **Inventor:** **Jean-Marie Nouel**, Hauts de Busseau,
77760 Villiers-sous-Grez (FR)(*) **Notice:** Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.(21) **Appl. No.:** **08/765,788**(22) **PCT Filed:** **Jul. 12, 1995**(86) **PCT No.:** **PCT/FR95/00935**§ 371 (c)(1),
(2), (4) **Date:** **Jan. 13, 1997**(87) **PCT Pub. No.:** **WO96/02868****PCT Pub. Date:** **Feb. 1, 1996**(30) **Foreign Application Priority Data**

Jul. 13, 1994 (FR) 9408726

(51) **Int. Cl.⁷** **G03F 7/00**(52) **U.S. Cl.** **430/302; 430/303; 101/453**(58) **Field of Search** 101/453, 454,
101/455, 456, 457, 458, 459; 430/302,
303(56) **References Cited****U.S. PATENT DOCUMENTS**809,157 A * 1/1906 Weyl
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pp. W11-W15.P Urban Die freie Kantenlänge: Indikator der Tonwert-
zunahme bei frequenzmodulierter Rasterung' the see whole
document—see page D.Deutscher Drucker, vol. 30, No. 6, Feb. 1994 Ostfildern DE,
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und FM-Rastern' see the whole document.

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Primary Examiner—Cynthia Hamilton(74) **Attorney, Agent, or Firm**—St. Onge, Steward,
Johnston & Reens LLC(57) **ABSTRACT**The present invention relates to the use of the frequency-
modulated screening or stochastic screening for lightening
the printing surfaces, in waterless or wet offset printing
techniques. It also concerns the films and plates used in these
printing techniques which, in characteristic manner, gener-
ate printing surfaces lightened by means of a stochastic
screening (or frequency-modulated screening).**6 Claims, No Drawings**

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USE OF FREQUENCY-MODULATED SCREENING FOR LIGHTENING OFFSET PRINTING SURFACES

The present invention relates to printing and has for a more particular object an original use of the frequency-modulated screening in wet or waterless offset, as well as films and plates modified depending on said screening.

It is known that wet and waterless offset printing techniques use supports or plates which comprise surfaces for absorbing the ink, so-called inkphilic surfaces, and surfaces for rejecting said ink, so-called non-inkphilic surfaces. In wet offset, the ink is rejected by a very thin film of water which adheres on the hydrophilic surfaces. In waterless offset, the inkphilic surfaces are based on a coating of silicones (on which the ink does not adhere). Said inkphilic and non-inkphilic surfaces are generated on said plates by techniques of exposure which employ films or directly from software.

On the printing machine, rollers coated with ink deposit said ink only on said inkphilic surfaces of a plate. A blanket, rubber-coated fabric, takes the ink of said ink-philic surfaces of said plate and deposits it on the material to be printed. It may be question of paper, cardboard, metal, etc.

It is therefore of prime importance, in order to obtain a correct result, that the ink catches successively on the ink-philic surfaces of the plate and then on the rubbery surface of the blanket and that it is finally deposited on the material to be printed.

Within the framework of wet offset, the ink should, furthermore, be mixed with a little of the water used for wetting the hydrophilic (inkphilic) surfaces.

The images are produced between two values which are, on the one hand, the "zero" value, i.e. the colour of the material to be printed, blank, and, on the other hand, a "maximum" value, i.e. the solid tint made with the chosen ink (black for black ink). All the intermediate values are obtained by using a screen, which is constituted by thousands of small squares. These may be empty—they represent a white surface, without ink—partially filled, or filled up to solid tint. All the shades are thus reproduced by solid tints of more or less large area. Said solid tints generally consist of dots, equidistant from one another, of an increasing diameter. Amplitude-modulated screens are spoken of. With this conventional screening, the reproduction of a half-tone image passes by the arrangement at equidistance of dots of which the size varies proportionally to the value of the tones of the original.

The screens are qualified by their number of lines to the linear inch.

Depending on the printing process employed and the nature of the material to be printed, more or less fine screens are used, such as screens 65, 80, 100, 120, 150, 175.

Ordinary, cheap papers such as newspaper paper, require a film of fluid, thick ink to cover their rough and absorbent surface. To print such papers, a large screen will have to be used: 65 or 80, for example. Good quality papers, which present a smooth, homogeneous surface, may be printed with a film of ink which is thin and concentrated in pigments. In this context, a very fine screen, 150 for example, may be used.

On carrying out the conventional techniques of which the principal characteristics have been recalled hereinabove, problems of the type set forth hereinbelow are frequently encountered.

The water-ink mixture, in wet offset, is not always made satisfactorily. It may contain too much water or, inversely,

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not enough water. The quality and productivity of the print are then penalized insofar as said ink may drip, dry poorly, remain on the blanket, etc.

The material to be printed, such as paper, does not always take all the ink deposited on the blanket. Said ink accumulates, "thickens", on said blanket. It is then necessary to interrupt printing and to wash said blanket.

The surface of the material to be printed, such as paper, leaves on the blanket residues, in the form of dust. The volume of residues is all the greater as the quality of the material to be printed is lower. When said volume attains certain limits, the blanket should also be washed.

The ink deposited on the blanket catches on the material to be printed. If the latter is fragile (case of paper), it will tear from time to time. Pieces of it then remain adhering on said blanket. Said pieces must then be removed and the blanket washed.

On sheet machines, there is also a particular problem insofar as, in the same way, the ink deposited on the blanket "sticks" or, "draws" the material to be printed (the sheet of paper). The latter, held by clips, then slides very slightly. Any slide, even of very small amplitude, brings about a deformation of the print, called double printing.

In wet offset, the reproduction of the screened images systematically undergoes an enlargement, of more or less great amplitude, qualified as "fattening". Such "fattening" affects the quality of the print a great deal, and it weighs it down, particularly on cheap papers (papers which oblige the printers to work with fluid inks).

In waterless offset, the inks used are more solid. Consequently, the "fattening" is less. On the other hand, said solid inks tend to "draw" the material to be printed, particularly paper, and therefore can to be used only on papers of a certain quality.

Applicant, faced with the problems set forth hereinabove, has recommended lightening said print, particularly in order to reduce the "fattening" and to facilitate print, more precisely to create small, non-inkphilic surfaces in the inkphilic surfaces. This technique of lightening has been described in Patent Application FR-A-2 660 245. It has given good results particularly on matt and/or ordinary papers, but it is delicate to employ on an industrial scale, particularly on coated and/or smooth papers.

In fact, by using a screen 120 and a value of 5% for example for said lightening, there are generated in the inkphilic surfaces non-inkphilic surfaces of $2240 \mu\text{m}^2$. Such a lightening causes the disappearance, partly and even totally, of too large a number of the dots which constitute the inkphilic surface representing the document to be printed. Print is removed and this may be seen in the details. There is also a loss in density. This has proved unacceptable in too numerous works.

By using, for the same lightening of 5%, a much finer screen, a screen 600 for example, there are generated in the inkphilic surfaces non-inkphilic surfaces which are very small ($88 \mu\text{m}^2$) and very numerous (about 25 times more). The inkphilic surface of the plate is thus riddled with these small surfaces which unfortunately render it fragile. Furthermore, it is very difficult to produce said tiny surfaces on an industrial scale at reasonable prices.

In general, the lightening thus carried out with a conventional screen—so-called amplitude-modulated screen—modifies the print too much, which is regrettable for numerous works. Moreover, precautions should be taken for said implementation in order to avoid the phenomenon of the moiré effect.

The implementation of the lightening, as recommended in Application FR-A-2 660 245 has therefore not, at the present time, given full satisfaction.

An original, particularly high-performance implementation thereof is proposed in accordance with the present invention. Such implementation employs a frequency-modulated screening or stochastic screening.

Such a screening does not use more or less large dot surfaces to reproduce the different values of shades, as is the case with conventional so-called amplitude-modulated screens, but a number of dots, all of the same surface, which varies for example from 1 to 100 to reproduce values of 1 to 100%. According to this screening, said dots of the same surface are distributed at random. In other words, with the frequency-modulated screening, all the dots have the same size, generally very small, but their number per surface zone (their frequency) varies depending on the value of the tones to be produced, and their distribution in space obeys a precise calculation of the assignment addresses (process of randomization). Unfortunately, such a distribution comprises the presence of agglomerates of dots.

Frequency modulation is not a novel process in the printing industry. It was used in low resolution for digital display, telecopying, etc. However, it was introduced in the printing industry only after the Seybold of Boston in April 1993. (On this occasion, the professionals learned that the Vignold group of enterprises of Essen had been working on this subject since 1992). From that date, numerous articles appeared on the subject (Deutscher Druck, Vol. 30, No. 10, February 1994, pages W11-W13 and pages W14-W15). Several companies propose this type of screening on the market. The firm Agfa proposes its Agfa Cristalraster technology, the firm Linotype-Hell its Diamond Screening technology, the firm Type Work GmbH its FINE GRAIN technology and the firm Barco its MONET technology.

However, frequency-modulated screens or stochastic screens are reserved at the present time for some rare specific printing works. In fact, they are virtually not employed insofar as their use raises serious problems.

Undeniable qualities are recognized when using such screens in printing, particularly:

- the absence of rosette,
- the absence of moiré effect between the colours,
- a more tolerant registry.

However, this use is reproached with the following:

a very delicate copy of the dots on the offset plate. In fact, if for example the Cristalraster screen of Agfa which has large dots is considered, said dots present in fact only the surface of a dot of screen 1% in conventional screen

a very delicate print of said dots on the paper due to a considerable fattening is difficult to avoid. In fact, on a printing machine, the dot is always reproduced with a ring. In relative percentage, this ring is all the greater as the dot is small. A faithful reproduction with so small screen dots is therefore almost impossible. unless the film has been specially modified, taking into account the document to be reproduced, the material to be printed, the ink used, etc. Such a modification of the film is no easy matter;

an irregular reproduction in the scale of the shade values. In fact, certain fractures are observed, doubtless by reason of the random formation of assembly of small dots agglutinating on one another and thus forming large inkphilic surfaces with, nearby, large, white, non-inkphilic surfaces. This particular point, detrimental to printing, seemed a priori to exclude the interest of stochastic screens from the original context of the invention, i.e. the de-printing or lightening. In fact, the

agglutination of small dots generating large surfaces, their intervention for de-printing could only be strongly prejudicial.

Therefore, at the present time, frequency-modulated screens or stochastic screens are available for printing, but their use remains extremely limited.

According to the present invention, it is proposed to use them in an original context, not for offset printing, but for de-printing, in fact for lightening the printing surfaces within the meaning of Application FR-A-2 660 245.

According to its first object, the invention therefore concerns the use of frequency-modulated screening or stochastic screening to lighten the printing surfaces, in waterless or wet offset printing techniques.

It has been recalled hereinabove, on the one hand, that the principle of lightening had been described in Application FR-A-2 660 245 and, on the other hand, the characteristics of the frequency-modulated screening or stochastic screening. None qualify this screening as modulated frequency technology yet.

In this original use of said screening (for de-printing), the problems which are faced with it in its conventional use (for printing) are not encountered or are avoided by a judicious implementation (cf. hereinbelow). On the contrary, very interesting results have been surprisingly obtained.

No real difficulties are encountered for effecting lightening (this is developed in greater detail in the present text) and said lightening, in the form of small dots, of the same small area, distributed at random, is not or may remain unprejudicial at the level of quality of the print. On the contrary, the general conditions of said print are improved: such improvement being all the substantial as the material to be printed, particularly paper, is of lower quality. It has even been ascertained, quite surprisingly, that the classical problems encountered during printing with very few inkphilic surfaces were less intensive, even eliminated when said inkphilic surfaces were lightened within the meaning of the invention.

More precisely, the application of the stochastic screens proposed at the present time for the purpose, not of creating inkphilic surfaces to deposit ink on a support but, on the contrary, of reducing the area of such inkphilic surfaces in accordance with the principle of lightening, has allowed said lightening to be effected:

- on all papers,
- easily (all the works may be carried out with only one or two sizes of dots),
- with relatively high percentages of lightening; up to nearly 30% in certain particular cases (without detriment to the quality of printing; hardly any incidence on the contrast and density of the inked surfaces, without provoking hatchings).
- with a strong positive impact on the "draught" of the inks, without generating moiré effect.

In this way, a lightening of 10-12%, perfectly acceptable if it is carried out with a stochastic screening under adequate conditions and which, at the level of the "draught" contributes considerable progress, cannot be acceptable if it is carried out with an amplitude modulated screening (problem of de-printing).

Such positive results of the stochastic lightening were in no way foreseeable.

However, said lightening is obviously carried out within reasonable limits.

According to the invention, said frequency-modulated screening is generally used for lightening said printing surfaces from 2 to 26%, advantageously from 8 to 14%. Very

satisfactory results have been obtained on several quite different papers, with a lightening of 6–14%. Surprisingly, such lightenings do not prove detrimental to printing even on fine papers, insofar as they are carried out adequately.

It will be specified here that the stochastic screens most currently used at the present time are generally used for the purposes of the invention—for the purposes of printing—i.e. those producing small dots with an area of about $400\ \mu\text{m}^2$.

However, the use of stochastic screens is in no way excluded from the scope of the invention

with smaller dots (with an area of about $196\ \mu\text{m}^2$ for example) for works on very fine, smooth paper (stamps, post cards);

with larger dots (with an area which may attain $1600\ \mu\text{m}^2$) for works on rough paper of the newspaper type.

The lightening according to the invention is carried out for a given work with dots of the same area, distributed at random, generally dots of about $400\ \mu\text{m}^2$. However, there is still a certain degree of freedom in the choice of the area of said dots for a given rate of lightening.

For effecting said lightening, software, films or plates adapted to generate lightened printing surfaces by a stochastic screening, are employed in conventional waterless or wet offset processes. Said films or plates constitute the second object of the present invention. As specified hereinabove, their printing surfaces, lightened by a stochastic screening, are generally lightened by 2 to 26%, advantageously from 8 to 14%.

This second object of the present invention also covers the apparatus (data-processing tools) useful for preparing the films themselves useful for producing the plates or directly useful for preparing the plates. Said apparatus contain the adequate software. In fact, the invention also has for an object the use in waterless or wet offset printing techniques, of software adapted to generate printing surfaces lightened by a stochastic screening, for the preparation of films or plates.

Said films or plates adapted to generate printing surfaces lightened by a stochastic screening, are described hereinafter in greater detail.

Concerning the films, lightened within the meaning of the invention, they present, depending on whether it is question of films representing the document to be reproduced which are negative or positive, small black lightening surfaces in the transparent parts or small transparent lightening surfaces in the black parts, said small surfaces being distributed in characteristic manner by means of a stochastic screening.

Such films are advantageously produced at the photo-engraver's. It is possible:

either to produce the films (positive or negative) so that the inkphilic parts reproducing the document have been lightened by means of stochastic screening;

or to use, for photographing the document to be reproduced, pre-processed films on which the small black or transparent surfaces have been previously introduced by printing or by exposure.

In fact, an adequate exposure is effected on the blank films in order to generate small black lightening surfaces in the transparent parts or small transparent lightening surfaces in the black parts, knowing that the light sent onto said blank films generates black surfaces thereon. This technique of exposure does not raise any particular problem.

However, Applicant has ascertained that its implementation for generating small transparent lightening surfaces in the black parts raised a problem in certain contexts beyond a certain lightening rate. Agglomerates of lightening dots detrimental to printing were then observed. The lightening

rate beyond which the observation of such agglomerates is intolerable obviously depends on the conditions of printing.

In any case, Applicant has contrived to prepare the films thereby lightening the printing at lightening rates greater than 5%, without detriment to said printing made on any paper and any machine. It is thanks to this contrivance that it is possible to recommend within the framework of the present invention the lightening, by means of a stochastic screening, up to rates close to 30% and more particularly up to rates of about 14% on very fine papers.

Thus, in order to prepare films which present small transparent lightening surfaces in the black parts, films useful for preparing positive plates, there are two ways of proceeding.

According to the first, conventional, way, a blank film is exposed in order to create, directly thereon, the small transparent surfaces required, distributed at random. The film obtained will not present any agglomerate if said small surfaces are introduced at low rate (low lightening rate) and will present some in an increasingly larger quantity if the quantity of introduction of such small surfaces is increased (high lightening rate). However, this may remain acceptable under certain particular conditions of printing.

According to the second, original, way, one proceeds in two steps. A first film is exposed in order to create thereon small black surfaces, distributed at random, and then said first film is copied on a second which constitutes the sought after lightened film. Surprisingly, thanks to this two-step technique, films with high rates of lightening can be prepared which do not present agglomerates of transparent surfaces.

The processed films—lightened by means of a stochastic screening—are used for exposing plates. Said plates characteristically present inkphilic surfaces and non-inkphilic surfaces; at least one part of said inkphilic surfaces containing small non-inkphilic lightening surfaces, distributed by means of a stochastic screening. It will be recalled here that said small surfaces, both at the level of the plates and of the films, theoretically present the same surface and are distributed at random (stochastic screening).

The plates lightened within the meaning of the invention are positive or negative plates. On these two types of plates, the lightening has not been effected in the same manner.

Concerning the positive plates, it is known that the photosensitive inkphilic layer is, by exposure, rendered soluble in the developer. It is therefore necessary, in order to create small, non-inkphilic surfaces in the photosensitive inkphilic layer, to send light through a film which presents the adequate small, transparent surfaces by means of a stochastic screening. This raises no problem. In fact, the man skilled in the art knows that a film presenting transparent surfaces of an area included between about 200 and $2000\ \mu\text{m}^2$ is copied without any difficulty.

The exposure of the positive plate, through said film, may be effected in different stages. It is advantageously effected upstream of the printing process, prior to any use of the plate. It may thus be envisaged to place on the market pre-exposed plates (having undergone lightening exposure and advantageously non-developed). Such positive plates form an integral part of the present invention. They are characterized in that they comprise a photosensitive inkphilic layer which has been exposed with a stochastic screen.

Such pre-exposed plates may be used:

directly for a second exposure with a positive film which comprises the document to be printed and a single development;

for a first development followed by a second exposure with a positive film which comprises the document to be printed and a second development.

In accordance with other variants, it is possible:

to expose, a first time, a positive plate with the document to be printed, develop it, take it for a second exposure through said lightening film and a second development (the small non-inkphilic surfaces have thus been introduced in the inkphilic surfaces);

to expose a positive plate with a single positive film which comprises both the document to be reproduced and the small transparent surfaces in the black parts and to develop said plate.

Concerning the negative plates, it is known, on the contrary, that the photosensitive inkphilic layer is, by exposure, rendered insoluble in the developer. It is therefore necessary, in order to create small non-inkphilic surfaces in the inkphilic parts, to stop the light through a film which presents the adequate small black surfaces (by means of a stochastic screening).

This may be effected in accordance with different variants.

According to a first variant, that necessary may be done at the level of the negative film which comprises the document to be printed. Said film will have been pre-processed in order to contain the adequate small surfaces.

According to a second variant, that necessary may be done at the level of the copy of the plate by employing two films: a film which presents the adequate small black surfaces (to stop the light) and a negative film which comprises the document to be printed. Manipulation of these two films may prove to be delicate.

In accordance with another variant, that necessary may be done at the level of the plate, before using it with the film which comprises the document to be reproduced. Small opaque surfaces are deposited on the photosensitive inkphilic layer of said plate. To that end, a film which comprises the small transparent lightening surfaces may be copied in a first step on a negative, preferably waterless offset plate. After exposure and development, a plate is obtained whose inkphilic parts represent the small surfaces, which will deposit the ink on the negative plates. To reinforce the opacity of the ink thus deposited, talcum, carbon black or equivalent is passed. One is thus certain to stop the light completely at the level of said small surfaces. It has furthermore been observed that the ink/talcum or carbon black assembly which gives said small surfaces a certain relief then reduces the time to make the vacuum in the exposure frame. It acts as an anti-blur agent when a vacuum is created in said frame for a perfect plating of the film comprising the document to be reproduced. This process is therefore particularly preferred. Said ink may also be deposited directly on the plate, by ink jet, which will stop the light.

According to another variant, that necessary may be done at the level of the preparation of the plate, at the level of the connection of its hydrophilic surface and its photosensitive inkphilic layer. A matter may thus be deposited on said hydrophilic surface, which prevents the adherence of the negative inkphilic layer at places (distributed by means of a stochastic screen), which will represent said small non-inkphilic surfaces in the inkphilic parts. This technique may in the same way be carried out for preparing positive plates.

Whatever the technique retained, the lightening by means of a stochastic screening does not raise any serious technical problem. According to the invention, only small dots are removed, in relatively small quantity. The balance of such lightening is, however, very positive.

The invention is illustrated by the following Examples:

EXAMPLE 1

The Agfa Cristalraster stochastic screen of the firm Agfa, "large dot" screen, is used for generating, at a rate of 5%, transparent surfaces each of $362 \mu\text{m}^2$, on a film.

A pre-sensitized, positive plate is taken and exposed with said film in a frame. Thousands of small surfaces of $362 \mu\text{m}^2$ thus see the light and may be eliminated at development.

Said plate is then exposed (second exposure) with the pattern to be printed, it is developed and gummed, as usual. Considering said plate with a magnifying glass, it may be seen that all its inkphilic parts contain, distributed at random, small surfaces where the inkphilic layer has been eliminated at development.

The plate is placed on-machine. Said machine is fed with ordinary paper which requires, for a good print, a thinned down ink and a thick film of ink.

It is ascertained that the print with such a plate is of quality greater than that obtained with a "non-lightened" plate. Said printing is, furthermore, carried out with fewer washings of the blanket and it is observed that the paper does not slide in the clips.

EXAMPLE 2

A positive plate is copied and developed normally.

Said developed plate is taken and exposed with a "lightened" film of the type prepared in Example 1.

After development (second development), a plate of the type obtained in Example 1 is obtained. Its inkphilic parts contain small non-inkphilic surfaces (without inkphilic layer) distributed at random.

The results at print are identical to those of Example 1.

EXAMPLE 3

A "lightened" film of the type prepared in Example 1 is used for copying a negative waterless offset plate.

With said plate, placed on-machine, thousands of small dots are deposited on negative offset plates. Said dots are rendered more opaque by coating them with talcum or with carbon black. Said small dots, rendered opaque, are thus capable of stopping the light (of preventing hardening of the inkphilic layer).

Said pre-processed plate is exposed with a negative film of the pattern to be printed.

This plate ensures a higher quality of print, with fewer problems. It is also ascertained that the small dots, with a height of about $2 \mu\text{m}$, facilitate evacuation of the air when a vacuum is created in the frame. In fact, they behave as "anti-blur" agents, by allowing the film to be coated around them.

EXAMPLE 4

A pre-sensitized positive plate is taken and exposed in a frame with a film made with a MONET stochastic screen of the firm Barco, of which the transparent dots have an area of about $390 \mu\text{m}^2$ and represent 12% of the surface of the film. Said film was made in the manner specified hereinafter.

A first film was prepared in conventional manner with 88% of transparent surfaces and therefore 12% of small black dots, dispersed virtually without agglomerate. Said film was then copied on a second film in a frame. After development, said second film presents 12% of transparent surfaces, formed by small dots of about $390 \mu\text{m}^2$. Said small dots present virtually no awkward agglomerates.

Said plate is then exposed (second exposure) with the pattern to be printed; it is developed and gummed as usual.

With a microscope, it may be seen that all the inkphilic parts contain small isolated surfaces where the layer left at development, and which are disposed at random.

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Said plate is placed on-machine and reproductions of photographs are printed in black on fine coated paper.

It is ascertained that the print is well stripped and that printing is effected more easily; the sheet of paper adhering little to the rubber blanket.

EXAMPLE 5

One proceeds as in Example 4, but with a film having only 4% of transparent surface formed by small transparent dots of $390\text{ }\mu\text{m}^2$.

Printing and the conditions of printing are substantially inferior to those of Example 4.

EXAMPLE 6 (comparative example)

A film having 12% of transparent surfaces (as in Example 4) but made with a conventional screen (amplitude-modulated screen) which has 300 lines to the inch (very fine screen) is used for lightening.

In order to obtain the 12% of transparent surface, the dots have a surface of about $850\text{ }\mu\text{m}^2$. After placing the lightened plate with said conventional screen on machine, it is ascertained that the density in the solid tints lowered by about 10% and that white dots are visible as soon as inking lowers a little.

Moreover, the reproductions of the photographs are more contrasted; fine details have more or less disappeared and thin lines are hatched in places. Furthermore, a certain moiré effect is observed, if the difference of 30° in the positioning of the two films (lightening film and film comprising the pattern to be printed) has not been respected.

EXAMPLE 7

One proceeds as in Example 4, but the transparent surface represents 16% of the surface of the film and this without awkward agglomerate of dots.

The paper is of the newspaper type and the reproductions are made under conventional newspaper printing conditions.

The print and the printing conditions are good.

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EXAMPLE 8

One proceeds as in Example 4, but the lightening film has been made with the stochastic screen in conventional manner (directly).

The quality of printing, on a fine coated paper, is inferior (presence of agglomerates of the small lightening dots).

However, the quality obtained would be acceptable with other printing supports of lower quality.

What is claimed is:

1. A printing plate for use in waterless or wet offset printing having a printing surface comprising inkphilic and non-inkphilic areas, said inkphilic area defining the image desired to have ink when printing is effected, wherein at least a part of said inkphilic area is lightened by inclusion of a plurality of small non-inkphilic surfaces thereon and wherein said small non-inkphilic surfaces are randomly distributed small dots of the same small area in said inkphilic area such that when ink is applied to said plate and adheres to the inkphilic area defining the desired image, said ink is prevented from adhering to said small, randomly distributed non-inkphilic surfaces.

2. The printing plate according to claim 1, wherein the total area of said small, randomly distributed, non-inkphilic surfaces is from 2 to 26% of said inkphilic area lightened thereby.

3. The printing plate according to claim 1, wherein the total area of said small, randomly distributed, non-inkphilic surfaces is from 8 to 14% of said inkphilic area lightened thereby.

4. The printing plate according to claim 1, where the said small randomly distributed, non-inkphilic surfaces are distributed according to a frequency-modulated screening or stochastic screening.

5. The printing plate of claim 4, wherein said small, randomly distributed non-inkphilic surfaces comprise dots having an area between about 196 and $1600\text{ }\mu\text{m}^2$.

6. The printing plate of claim 4, wherein said small, randomly distributed non-inkphilic surfaces comprise dots having an area of about $400\text{ }\mu\text{m}^2$.

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